

Nuclear DNA content in the red conger eel *Genypterus chilensis* (Guichenot, 1881) (Actinopterygii: Ophidiidae)

Contenido de ADN nuclear en el congrio colorado *Genypterus chilensis* (Guichenot, 1881) (Actinopterygii: Ophidiidae)

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ABSTRACT

Studies about nuclear DNA content in the genus *Genypterus* are scarce, and the present study gives the first estimate of nuclear DNA content of *Genypterus chilensis*, with a value of $2C = 1.0 \pm 0.06$ pg, value close to that obtained for other Ophidiidae species which range between 1.2 and 1.68 pg.

RESUMEN

Los estudios sobre contenido de ADN nuclear en el género *Genypterus* son escasos, y el presente trabajo entrega por primera vez la estimación del contenido de ADN nuclear de *Genypterus chilensis* con un valor $2C = 1,0 \pm 0,06$ pg, valor cercano al descrito para otras especies de Ophidiidae que varían entre 1,2 y 1,68 pg.

Genypterus chilensis (Guichenot 1881) is an abundant fish species distributed along the coasts of the Southeastern Pacific Ocean. In Chile the species is distributed from Arica (18°S) to Archipiélago de los Chonos (47°S), with a bathymetric distribution between 20 and 150 m. At present, the available biological studies on *G. chilensis* include parasitism, population dynamics, and temporal variation of the diet, reproductive cycle, and DNA-microsatellite characterization (Vergara & George-Nascimento 1982; Paz 1991; George-Nascimento *et al.* 2004; Chong *et al.* 2006; Chong & González 2009; Canales-Aguirre *et al.* 2010). However, cytogenetic data on *G. chilensis* are not available and basic aspects such as nuclear DNA content remain unknown.

In a recent survey on cytogenetic studies of Chilean fishes, 27 species were registered with data on chromosome number, karyotype morphology and/or nuclear DNA content (García 2010). This number of studied species represents ca. 2.7% of the fish Chilean diversity. It is remarkable, that data on nuclear DNA content are only available for the freshwater *Trichomycterus areolatus* Valenciennes 1846 (Trybomictoridae), *Galaxias maculatus* (Jenyns 1842)

and *Galaxias platei* Steindachner, 1898 (Galaxiidae) (Colihueque *et al.* 2006; Jara-Seguel *et al.* 2008a, 2008b), while for the marine fishes only *Sardinops sagax* (Jenyns 1842) (Clupeidae) and *Genypterus blacodes* (Schneider 1801) (Ophidiidae) have been examined (Hardie & Hebert 2004).

In order to increase the cytogenetic data of the *Genypterus* genus, the goal of this work is to estimate for the first time the nuclear DNA content of *Genypterus chilensis* that inhabits the Chilean coast.

Individuals of *Genypterus chilensis* were collected from Bahía Quintay (33°11'S; 71°1'W), Región de Valparaíso, Chile. These specimens were maintained in hatcheries at the Centro de Investigaciones Marinas Quintay (CIMARQ; Universidad Andrés Bello). Measurements of nuclear DNA content (2C-values) were done by Feulgen microdensitometry in erythrocyte smears, using the software Nis-Elements (Nikon, Yokohama, Japan). Blood samples were taken from the caudal vein of three specimens, and 100 erythrocyte nuclei were analysed for each of them (300 cells in total). To estimate 2C DNA content the cytological

and microdensitometrical method described in detail by Jara-Seguel *et al.* (2008a; 2008b) in erythrocyte nuclei of *Galaxias* species (Galaxiidae) was followed. In this method the software estimates values of integrated optical density (IOD) of each erythrocyte nuclei, and the 2C-value is then obtained by comparison with erythrocyte smears of *Oncorhynchus mykiss* (Walbaum, 1792) used as standard (2C = 5.5 pg, 2n = 58-62 chromosomes) (Carvalho *et al.* 2002).

The 2C-value estimated in erythrocytes of *G. chilensis* was 1.0 ± 0.06 pg (IOD = 19.32 ± 1.24 arbitrary units) and the coefficient of variation was of 6.4%. According to these results, the C-value of *G. chilensis* is 0.5 pg. The mean IOD for the standard *O. mykiss* was 107.0 ± 4.02 arbitrary units (2C = 5.5 pg). *G. chilensis* showed a C-value near to its sister species *G. blacodes* (0.6 pg) and to co-familial members previously studied [*Ophidion scrippsae* (Hubbs, 1916), *O. welshi* (Nichols & Breder 1922), *Siremba imberbis* (Temminck & Schlegel, 1846)] (Table I). Thus, the range of C-values described for Ophidiidae vary between 0.5 and 0.84 pg (mean 0.65 ± 0.12 pg) being lower to the average 1.2 pg documented for Teleost fishes. However, the C-value of *G. chilensis* is within the range recorded for Teleosts (C-value from 0.4 to 4.4 pg) (Gregory *et al.* 2006).

In general, in teleost fish there is little variation in basal genome size and alterations in C-value ordinarily appear to have resulted from the accretion and/or deletion of small blocks of DNA (Gregory & Hebert 1999). However, although these alterations may modify the karyotype structure (Takai & Ueno 1997), Robertsonian translocations are the most important mechanisms of chromosome evolution in fishes (Vitturi & Catalano 1988; Winkler *et al.* 2004). Karyotype studies in *Genypterus* species have not been carried out, and represent a pending task for the near future.

In fishes, estimations of C-values have increased in recent decades and this is by far the best represented group in the current databases on the subject with ca. 1,300 examined species (Gregory *et al.* 2006; Smith & Gregory 2009). *Genypterus* species are important as a food resource, being currently obtained by artisanal fishing methods. Because of over fishing, a reduction of their population has been observed. Consequently, aquaculture programs have begun farm production of this species, for which genome data can be important to its improvement and management (Martínez 2005). The present work supplies valuable data on C-value for this teleost fish, thus increasing the framework on cytogenetic information for Ophidiidae species inhabiting in Southeastern Pacific Ocean and showing a wide distribution in Chilean coasts.

TABLE 1. Nuclear DNA content (C-Value) for *Genypterus chilensis* and others Ophidiidae species.

TABLA 1. Contenido de ADN nuclear (valor C) para *Genypterus chilensis* y otras especies de Ophidiidae.

Species	C-value (pg)	Reference
<i>Genypterus chilensis</i>	0.5	Present work
<i>G. blacodes</i>	0.6	Hardie & Hebert (2004)
<i>Ophidion scrippsae</i>	0.68	Hinegardner (1968)
<i>O. welshi</i>	0.84	Hinegardner & Rosen (1972)
<i>Siremba imberbis</i>	0.63	Hardie & Hebert (2004)
Teleost fishes (average)	1.2	Gregory et al. (2006)

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